

Description

SCANNING DEVICE HAVING REDUCED SCANNING TIMES AND METHOD RELATED THERETO

BACKGROUND OF INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a scanning device, and more particularly, to a scanning device capable of reducing document scanning times.

[0003] 2. Description of the Prior Art

[0004] Scanning devices, such as fax machines, scanners, copiers, or multi-function products with integrated print, scan and faxing functions, are popular electronics devices. These devices have a scanning device for obtaining a corresponding image from a document.

[0005] Please refer to Fig.1, which is a block diagram of a conventional scanning device 10 according to the prior art. The scanning device 10 comprises a cover 11, a housing

12, a cold cathode fluorescent lamp (CCFL) 14, a photo-sensor 16 and a controller 18. The CCFL 14 is used for producing light. The photosensor 16, which can be a Charge-Coupled Device (CCD), is used for detecting light produced by the CCFL 14 that reflects off of a document 15. The controller 18 is used for controlling internal operations of the scanning device 10.

[0006] The basics of the scanning device 10 are described as follows. First, the desired document 15 is placed onto the scanning device 10 and the cover 11 is closed, which prevents ambient light from influencing the scanning process. Then, the CCFL 14 generates light to illuminate the document 15, and the photosensor 16 detects the reflected light from the document 15. Since less light is capable of being reflected from dark areas of the document 15, while more light is reflected from the bright areas of the document 15, the photosensor 16 is able to detect the corresponding intensity variations of the reflected light. Finally, the controller 18 transforms the detected intensity patterns of the reflected light into digital data, and combines these digital data into an image file.

[0007] Please refer to Fig.2 in conjunction to Fig.1. Fig.2 illustrates a relationship between intensity variations of the

cold cathode fluorescent lamp versus time during a warm-up time period. Color image information is obtained by using the CCFL 14 of the scanning device 10 to scan a single time, and this is possible when a sufficiently stable and bright light is produced by the CCFL 14. To do so, the CCFL 14 must reach a sufficiently high temperature to excite enough ions to strike the fluorescent material disposed on the glass tube of the CCFL 14. In general, the period required to heat the CCFL 14 to the appropriately high temperature is called the warm-up time period. A so-called warm-up time period ($t_0 \sim t_1$), with values of 45 to 90 seconds, is typically required. During the warm-up time period, a substantial luminance variation of the light provided by the CCFL 14 is exhibited. If the luminance variation is too great, corresponding errors for the reflected light detected by the photosensor 16 are created. From Fig.2, the luminance variation of the light provided by the CCFL 14 in the period between $t_0 \sim t_1$ is too great to permit color scans. As an example, during the period of $t_a \sim t_b$ as illustrated in Fig.2, when using the CCFL 14 to scan the area 17 of the document 15 having a uniform gray level, ideally the photosensor 16 should detect the same reflected light luminance. However, because the lumi-

nance of the light provided by the CCFL 14 at the time t_b is larger than that at the time t_a , the photosensor 16 detects a different luminance for the same gray-level area 17, causing the controller 18 to read error-laden data, which leads to incorrect image data. Hence, the CCFL 14 of the conventional scanning device 10 requires a relatively long warm-up time for generating a sufficiently stable and bright light to ensure a high quality scan.

[0008] To reduce scanning times while maintaining high quality scans, the scanning device 10 may be provided more than one CCFL 14. In this way, higher light intensities are available, but the warm-up time period remains unchanged. This is a waste of time for the user.

SUMMARY OF INVENTION

[0009] It is therefore a primary objective of the claimed invention to provide a scanning device for reducing scanning times and for providing scanning during the warm-up time period to solve the above-mentioned problems.

[0010] Briefly summarized, the claimed invention provides a scanning device having a housing, a cold cathode fluorescent lamp (CCFL), and a light emitting diode (LED), both for emitting light, a photosensor for detecting light that is emitted from the CCFL and the LED, and which is then re-

flected from a document, and a control circuit for controlling operations of the scanning device.

[0011] It is an advantage of the present invention that the LED may be used to perform scanning while the CCFL is being heated, thereby eliminating the need of the user to wait upon the warm-up time of the CCFL.

[0012] These and other objectives of the claimed invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment, which is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0013] Fig.1 is a block diagram of a conventional scanning device according to the prior art.

[0014] Fig.2 illustrates a relationship between luminance variations of a cold cathode fluorescent lamp depicted in Fig.1 versus time.

[0015] Fig.3 shows a block diagram of a scanning device according to the present invention.

[0016] Fig.4 illustrates a relationship among luminance variations of a first light source and a second light source depicted in Fig.3 versus time.

[0017] Fig.5 illustrates a block diagram of a computer system us-

ing a scanning device according to the present invention.

[0018] Fig.6 is a flowchart for the block diagram of Fig.5.

[0019] Fig.7 is a perspective view of a multi-function product with a scanning device according to the present invention.

[0020] Fig.8 is a block diagram of the multi-function product depicted in Fig.7.

DETAILED DESCRIPTION

[0021] Please refer to Fig.3, which shows a block diagram of a scanning device 20 according to the present invention. The scanning device 20 comprises a housing 22, a scanning module 23, a photosensor 28, and a controller 30. The scanning module 23 comprises a first light source 24 and a second light source 26, both of which are used to produce light to illuminate a document 25. The photosensor 28 is used for detecting light generated by both the first light source 24 and the second light source 26 that is reflected from the document 25. The controller 30 is used for controlling operations of the scanning device 20. The warm-up time period of the first light source 24 is longer than that of the second light source 26. The first light source 24 can be a cold cathode fluorescent lamp (CCFL). The second light source 26 can be a white-light light

emitting diode (LED). The photosensor 28 can be a charge coupled device (CCD).

[0022] Please refer to Fig.4, which illustrates a relationship between brightness variations of the first light source 24 (curve A) and the second light source 26 (curve B) versus time according to the present invention. In the illustrative embodiment, the first light source 24 and the second light source 26 are turned on simultaneously (time t_2 shown in Fig.4). The second light source 26 (curve B) is capable of quickly emitting stable light, unlike the first light source 24 (curve A), which needs 45 to 90 seconds of warm-up time. Therefore, after enabling the second light source 26, the second light source 26 can generate light, however its luminance is lower than the light that the first light source 24 generates after being heated. During the warm-up time period of the first light source 24, only the second light source 26 is used to scan the document. During this time, the first light source 24 is heated. In general, the warm-up time period of the first light source 24 needs about 45–90 seconds. Suppose that the warm-up time period of the first light source 24 in this illustrative embodiment is 45 seconds (t_3 as shown in Fig.4), and so 45 seconds is set as a predetermined time. When the prede-

terminated time of 45 seconds is reached, the controller 30 simultaneously enables both the first light source 24 and the second light source 26, so that both light sources 24, 26 provide document illumination. Then, the accumulated light luminance from the first light source 24 and the second light source 26 results in a more precise gray level of the reflected light detected by the photosensor 28, and a lowered exposure time. Finally, the controller 30 transforms the different detected gray levels of light into corresponding digital data, and recombines these data to generate an image file readable by a computer.

[0023] The scanning device 20 shown in Fig.3 is a platform scanner. However, the scanning device 20 also can be a flat bed scanner, a paper fed scanner, a copier, a Fax machine, or a multi-function product (MFP). Furthermore, both the second light source 26 and the first light source 24 are installed within the scanning module 23.

[0024] Please refer to Fig.5, which shows a block diagram of a computer system 40 using the scanning device 20 according to the present invention. For simplicity, elements that have the same function as that illustrated in Fig.3 are provided the same item numbers used in Fig.5. The scanning device 20 can be a flat bed scanner or a document

fed scanner. In the illustrative embodiment, the computer system 40 comprises a display device 42 for displaying images, and an image application 44, such as Photoshop published by Adobe, PhotoImpact and Photo Express published by Ulead, or OmniPage Limited Edition published by Caere. Such programs are used to initiate the operations of the scanning device 20. These applications have such functions as "preview" and "scan". How the computer system 40 cooperates with the image application 44 and the scanning device 20 is described as follow:

- [0025] Please refer to Fig.6 in conjunction to Fig.5. Fig.6 is a flowchart for the block diagram depicted in Fig.5 according to the present invention.
- [0026] Step 100:Start.
- [0027] Step 102:Implement "preview" function.
- [0028] Step 104: The scanning device 20 simultaneously enables the second light source 26 and the first light source 24. The first light source 24 begins heating.
- [0029] Step 106:Perform preview scanning using the second light source 26 and the heating first light source 24.
- [0030] Step 108:Show the preview result on the display device 42 of the computer system 40.

- [0031] Step 110: Implement the "scan" function.
- [0032] Step 112: Scan the document using the second light source 26 and the heated first light source 24.
- [0033] Step 114: Show the scan result on the display device 42 of the computer system 40.
- [0034] Step 116: End.
- [0035] Regardless of whether it involves the entire document or only a portion of the document, the user is capable of performing a "preview" function provided by the image application 44 through an input interface 46, such as a mouse or a keyboard, to verify the scanning scope of the document (step 102). Then, the computer system 40 sends a control signal to the controller 30 of the scanning device 20 to enable both the second light source 26 and the first light source 24 (step 104). Because the second light source 26 is capable of providing stable light immediately, the controller 30 can preview scan the document by using the second light source 26 in cooperation with the heating first light source 24 (step 106). The preview scan result can be shown on the display device 42 of the computer system 40 (step 108). The user may indicate which region of the document he or she desires, based on

the preview scan results. By this time, the first light source 24 has warmed up. The user is capable of performing a "scan" function provided by the image application 44 through an input interface 46 to scan the desired region of the document using both the second light source 26 and the first light source 24. Finally, the scan results can be shown on the display device 42 of the computer system 40. From the above method, the heated second light source 26 and the heating first light source 24 can be used for performing preview scans, providing a copious warm-up time period for the first light source 24. In this way, the user can efficiently utilize the image application software 44 cooperating with the second light source 26 and the first light source 24.

[0036] Please refer to Fig.7 and Fig.8. Fig.7 is a perspective view of the multi-function product 50 with the scanning device 20 according to the present invention. Fig.8 is a block diagram of the multi-function product 50 according to the present invention. The multi-function product 50 comprises an operations pad 52, a scanning module 23, a photosensor 28, and a controller 30. A first light source 24, which is a CCFL, and a second light source 26, which is a white light LED, are installed within the scanning

module 23. The operations pad 52 has a control button 54 and a start button 56. When the start button 56 is pressed, the controller 30 turns on the first light source 24 and the second light source 26. When the control button 54 is pressed, the controller 30 only turns on the second light source 26. For simplicity, elements that have the same function as that illustrated in Fig.3 are provided the same item numbers used in Fig.7.

[0037] Conventionally, the scanning module within the multi-function product requires a warm-up time period so as to heat the CCFL to a sufficient temperature. In other words, if the user only wants to copy or fax the document, he or she must wait a relatively long time due to the warm-up time period of the CCFL. However, using the present invention multi-function product 50, if the user only desires to facsimile or copy a document with a low scan quality, triggering the control button 54 to only enable the second light source 26, which is capable of generating stable light quickly, is available without waiting for the additional warm-up time period of the first light source 24. If the user desires to scan the document with a high quality scan, triggering the start button 56 to enable both the first light source 24 and the second light source 26 is

needed. In this way, the user avoids waiting for the warm-up time period of the first light source 24.

[0038] In contrast to the prior art, the present invention scanning device is capable of performing a low quality scan by using the LED during the warm-up time period of the CCFL, and performing a high quality scan by using both the heated CCFL and the LED. This provides convenience for the user, who can utilize the LED to perform a low quality scan while the CCFL is being heated to avoid waiting for the warm-up time period of the CCFL.

[0039] Those skilled in the art will readily observe that numerous modifications and alterations of the device may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.